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ABSTRACT

The views of biology department heads concerning the state of the art in program development were surveyed. A random sample of 132 biology department heads in state-supported colleges and universities responded to questions focusing on program development and curriculum aspects. The responses were compared to those of English, history, and mathematics department heads. Findings include the following: over 50 percent of the biology departments were not engaged in experimentally testing small units of curriculum or courses prior to full implementation, while English departments were doing far more in this area of concern than were the other three departments; 64 percent of biology departments incorporated objectives in their curriculum efforts more than a small amount or to a great extent; 43 percent of the department heads in biology stressed individualized instruction, but only 26.5 percent of biology departments were accommodating for differences among students more than a small amount or to a great extent; English departments were doing more in the area of individualized instruction; over 83 percent of the biology departments used the straight lecture approach to teaching; and 15.2 percent of the biology departments were doing more than a small amount and 3.8 percent were doing a great deal to provide the time, consultants, inservice training, and financial resources to adequately attempt curriculum evaluation. Based on responses to other questions, it is recommended that a greater effort should be made to help faculty learn a variety of teaching strategies and a number of different ways to individualize instruction. More diagnostic testing of students is also recommended. A questionnaire is appended. (SW)

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A NATIONAL SURVEY OF CURRICULUM DEVELOPMENT: BIOLOGY DEPARTMENT CHAIRMEN PERCEPTIONS COMPARED WITH PERCEPTIONS OF OTHER CHAIRMEN IN STATE SUPPORTED COLLEGES AND UNIVERSITIES.

Glenn Ross Johnson and Geneva Morris

When it comes to curriculum development, most departments simply develop a set of courses for approval by their colleges and universities--they make the assumption that simply developing a set of courses is all one does when building a curriculum. However, incorporating recommended procedures for curriculum development is a better way to assure one of a good program.

This article explores three research question: What is the state-of-the-art in program development as viewed by department chairmen within Biology Departments in state supported colleges and universities of the United States? To what extent are Biology Departments incorporating recommended procedures for curriculum development? Do the perceptions of chairmen for Biology Departments differ from the perceptions of chairmen for Departments of English, History, and Mathematics when they are quarried about program development procedures and other curriculum aspects?

Subjects

A random sample of 132 chairmen of Biology Departments in state supported colleges and universities of the United States responded to a set of questions which focused upon program development and curriculum aspects. Their responses were compared to those of a random sample of chairmen in departments of English (132), History (129), and Mathematics (130).

A table of random numbers was used to select the departments in state supported colleges and universities listed in the Education Directory for Colleges and Univeristies published by the Center of Educational Statistics. Over sixty percent responded to the survey.

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Procedures

Using the current literature, a list of key factors to consider in program development was identified. The list generated the development of a series of survey items which were discussed informally with college instructors and academic deans. A small pilot study involving post-secondary institutions was conducted, and the questions were refined. Later, the questions were used in national surveys involving academic affairs officers in junior/community colleges and in state supported colleges and universities (Johnson, 1979, 1980). Curriculum related items were worded in question format, and each question was followed by a set of five descriptions from which the respondents would mark the one expressing best his/her perception of the present state-of-the-art regarding each of the twelve items. The items appear in Appendix A.

The following is an example of one of the survey instrument's items:

1. To what extent has your department used a conceptual or theoretical framework as a guide in curriculum development efforts?

_____not at all

_____hardly at all

_____a little bit

_____more than a little bit

_____to a great extent.

The format permitted the investigator to apply a numbering system to a Likert Scale: not at all=1, hardly at all=2, a little bit=3, more than a little bit=4, to a great extent=5.

The data were collected through a mail out questionnaire with approximately a sixty-one percent return from each of the four disciplines. The data were run through the University's AMDAHL 470/V6/V8 computer using the SPSS Statistical Packages.

Findings from Biology Departments

The first item asked the following question: To what extent has your department used a conceptual or theoretical framework as a guide in curriculum development efforts? Developing a framework is not easy, and it can become confusing because of our multiple cultures, lack of agreement over learning theory, different philosophies, and argument among professors of science and social science. However, programs are further ahead in the long run when time has been used to develop a faculty consensus regarding the conceptual or theoretical framework to use as a guide in the curriculum effort. Biology Departments where they use such a framework only a little bit (20%), hardly at all (12%), or not at all (6.4%), need to rethink this item. The mean was only 3.64 which indicated a need for improvement in this area. However, that was true for all four departments (Biology, English, History, Mathematics) since an analysis of variance revealed no significant differences among the four departments with item one.

The second question did reveal a significant difference among the four departments. The item asked: To what extent has your department experimentally tested small units of curriculum o. courses prior to full implementation? Pilot testing units or courses appears to be a good way to prevent a lot of agony at a later date, expecially if the course proves to be a mistake. Field-testing provides time to make modifications and adjustments to courses prior to full adoption. Some institutions like to use several sections of the same course to experiment---a random number of sections are taught using the existing program. Achievement test data and attitudinal data from both groups of sections can be analyzed to see if expected outcomes emerge. Unfortunately, a very large percentage of Biology Departments were not engaged in such activities---over 50% marked "not at all", "hardly at all", or "only a little bit".

The analysis of variance revealed that English Departments were doing far more in this area of concern than were the other three departments.

The third item asked: To what extent has your department used a "needs assessment" in curriculum development prior to curriculum or course development or revision? The needs assessment (diagnosis) is one of the most important aspects of curriculum development. Data collected via a needs assessment helps departments identify deficiencies in their existing programs. It leads departments to explore new areas, and it helps them identify problems students are having. A good needs assessment will obtain data from former students, prospective employers of the department's graduates, present students, and professional agencies identified with the discipline. Over 41% of the Biology Departments in the United States failed to use a needs assessment more than "a little bit of time" or "to a great extent of the time."

An analysis of variance showed no significant differences among the four departments in their use of a needs assessment. It is possible that post-secondary institutions simply are not well versed in the use of a needs assessment. If that were the case, perhaps we will see an increased use of it in program development when departments discover the procedures used with a needs assessment.

Item number four asked: To what extent has your department put into writing a clear and comprehensive set of objectives? The data one collects from a needs assessment leads to revising existing objectives and establishing new objectives. Objectives become the foundation for the total curriculum effort. Departments should constantly return to objectives established for the discipline in order to have proper guidance in content selection, development of learning experiences, selection of materials, and formation of evaluation procedures. Sixty-four percent of the Biology Departments incorporating objectives in their curriculum efforts "more than a little bit of the time" or "to a great extent of the time."

An analysis of variance showed no significant differences among the four departments for item four.

Item five asked: To what extent has your department used relevant learning experiences to accommodate for differences in individual student ability and motivation? For decades we have recognized the fact that differences exist within individuals and among groups of people. We simply haven't become very sophisticated in dealing with the vast differences among students in classroom settings. We have only scratched the surface of the problem when we attempt to develop self-paced programs (e.g., audio-tutorial, programmed texts) since all students enrolled end up pursuing the identical objectives with the identical material and completing the identical evaluation (test questions). That is NOT individualizing instruction. Such programs are excellent and I highly recommend their use--however, they only provide for self-pacing, NOT individualizing of instruction.

With a mean of 2.90, only 26.5% of the Biology Departments were accommodating differences among students "more than a little bit" or "to a great extent."

Analysis of variance revealed significant difference among the departments---English did more in this area than Biology.

The sixth item was: To what extent has your department stressed individualized instruction? This item was another way of gettting to the question of accommodating for differences (see item 5 above). Since 43% of the department chairmen in Biology stressed individualized instruction, but only 26.5% of Biology Departments were accommodating for differences among students, one can only conjecture that faculty members either resist attempts to individualize instruction or they lack the knowledge and skill to individualize instruction.

Analysis of variance revealed significant differences among the departments. Again, English Departments were doing more in this area.

Item number seven asked: To what extent has your department used the "straight lecture" approach in teaching? This was a further attempt to verify the data collected in items five and six. Lecturing dominated the college setting. There is nothing wrong with a well conceived, well developed, excellently presented lecture. Unfortunately, the lecture can not accommodate all the different objectives one developes for a course. Many objectives should lead instructors to different teaching modes (e.g., discussion, simulation and role playing, case studies) as better ways for the students to learn. Variety also enhances student motivation. The mean score of 4.27 came as no surprise to the investigator. Over 83% of the Biology Departments used the "straight lecture" approach in teaching.

Analysis of variance revealed a significant difference--English Departments were doing far more than Biology and the other two departments in moving away from a use of the "straight lecture" approach.

Item number eight asked: In your department, to what extent have faculty members recognized and/or valued individual differences among students as opposed to treating or considering all students alike? The findings gave some support to this investigator's viewpoint that faculty need help in developing individualized programs or alternatives to the lecture. Sixty-four percent marked "more than a little bit" or "to a great extent." In other words, faculty members do recognize differences--they probably don't know what to do about the problem.

Analysis of variance revealed significant differences among the four departments with English departments showing a higher mean.

A ninth item asked: To what extent do you believe faculty members in your department engage students in critical thinking during class time (as opposed to having students engage in direct recall of basic facts)?

With society in a constant state of change, we must give students opportunities

to develop their critical thinking skills. How else can our future citizens cope with issues involving political situations, morals, values, cultural needs, and environmental conditions?

Biology Departments appear to be responding to this concern since the mean was 3.78. However, analysis of variance revealed significant differences among the four departments--English (4.4), History (4.2), Math (3.9), and Biology (3.78).

A tenth item asked: To what extent do you believe faculty members in your department attempt to diagnose gaps in achievement (weaknesses) of students at the beginning of their courses by administering pre-course tests or by using some other form of assessment? Early analysis of where students are in a course can be helpful to both the teacher and the students. Students lacking prerequisite knowledge essential to succeed in the course can be counseled out in time to obtain help. If the gaps are minor and correctable in class, the instructor may revise his tentative course outline to provide information which would correct the situation.

Biology Departments did not fare well with the above item--a mean of 2.41. Analysis of variance revealed signification differences: English (3.43), Math (3.43), Biology (2.41), and History (2.1).

An eleventh item asked: To what extent has your department been provided the time, consultants, in-service training, and financial resources to adequately attempt curriculum evaluation? Support and availability or resources are imperative to the success of any curriculum effort. To deny such support is to invite failure. Only 15.2% of the Biology Departments were doing the above "more than a little bit" while 3.8% were providing the above "to a great extent." The mean was 2.29 for Biology Departments.

Analysis of variance revealed no significant differences among the four departments---they were all below a mean of 2.4.

The final item asked: To what extent has your department developed a systematic plan prior to undertaking curriculum development or curriculum revision? To a great extent, the success of a curriculum effort depends upon systematic planning. There are all kinds of factors to consider when engaged in a revision of a program: committee membership, decision boundaries, leaders for task forces, consultants, and development of needs assessment procedures. Over 40% of the Biology Departments were not responding to the above either "more than a little bit" or "to a great extent." They should recognize that Biology Departments responding to this need are probably among those with the more viable programs.

Analysis of variance revealed no significant differences among the four departments.

Concluding Statement

There were a few areas in particular where Biology Departments across the nation appear to be vulnerable. The author respectfully submits the following suggestions for consideration:

1. Biology Departments need to give more careful consideration to a conceptual framework and a systematic plan prior to development.
2. New courses or changes in programs need to be pilot tested or experimentally tested prior to full scale implementation.
3. More consideration should be given to the use of a "needs assessment" as part of the curriculum effort.
4. A greater effort should be made to help faculty learn a variety of teaching strategies and a number of different ways to individualize instruction. The lecture simply is not appropriate for all important objectives in the curriculum for higher education settings.

5. More diagnostic testing of students should take place early in courses so corrective measures can be employed with those students lacking the basic knowledge and skills to succeed in Biology courses.
6. Time, consultants, in-service programs, and financial resources need to be provided to Biology faculty if curriculum and program efforts are to be successful.

1.0

References

Glenn Ross Johnson, "Curriculum Development in Junior/Community Colleges: The 'State-of-the-Art' as Viewed by the Academic Affairs Officer," ERIC Resources in Education, November, 1979, ED 188 710.

Glenn Ross Johnson, "Curriculum Development in State Supported Senior Colleges and Universities: The 'State-of-the-Art' as Viewed by the Academic Affairs Officer," ERIC Resources in Education, May, 1980, ED 196 324 HE 013 287.

APPENDIX A

The State-of-the-Art Curriculum Development Questions for the Survey

For each item, the department chairman was asked to select one of the following choices:

_____not at all

_____hardly at all

_____ a little bit

_____more than a little bit

_____ to a great extent

1. To what extent has your department used a conceptual or theoretical framework as a guide in curriculum development efforts?
2. To what extent has your department experimentally tested small units of curriculum or courses prior to full scale adoption?
3. To what extent has your department used a "needs assessment" in curriculum development prior to curriculum or course development or revision?
4. To what extent has your department put into writing a clear and comprehensive set of objectives?
5. To what extent has your department used relevant learning experiences to accommodate for differences in individual student ability and motivation?
6. To what extent has your department stressed individualized instruction?
7. To what extent has your department used the "straight lecture" approach in teaching?
8. In your department, to what extent have faculty members recognized and/or valued individual differences among students (as opposed to treating or considering all students alike)?

Appendix A (continued)

9. To what extent do you believe faculty members in your department engage students in critical thinking during class time (as opposed to having students engage in direct recall of basic facts)?
10. To what extent do you believe faculty members in your department attempt to diagnose gaps in achievement (weaknesses) of students at the beginning of their courses by administering pre-course tests or by using some other form of assessment?
11. To what extent has your department been provided the time, consultants, in-service training, and financial resources to adequately attempt curriculum development, curriculum revision, or course and curriculum evaluation?
12. To what extent has your department developed a systematic plan prior to undertaking curriculum development or curriculum revision?

TABLE 1

Distribution of Response from the National Random Sample of Biology Department Chairmen

Item Number		*Likert Scale 5	4	3	2	1	No Response	Mean
1	Frequency	34	43	25	15	8	7	3.64
	Percent	27.2	34.4	20.0	12.0	6.4		
2	Frequency	20	36	45	17	14	0	3.23
	Percent	15.2	27.3	34.1	12.9	10.6		
3	Frequency	32	43	35	13	7	2	3.62
	Percent	24.2	32.6	26.5	9.8	5.3		
4	Frequency	32	52	21	14	12	1	3.60
	Percent	24.2	39.4	15.9	10.6	9.1		
5	Frequency	13	22	47	34	13	3	2.90
	Percent	9.8	16.7	35.6	25.8	9.8		
6	Frequency	16	41	38	26	11	0	3.19
	Percent	12.1	31.1	28.8	19.7	8.3		
7	Frequency	68	42	12	9	1	0	4.27
	Percent	51.1	31.8	9.1	6.8	0.8		
8	Frequency	25	44	32	23	7	1	3.44
	Percent	18.9	33.3	24.2	17.4	5.3		
9	Frequency	26	59	39	8	0	0	3.78
	Percent	19.7	44.7	29.5	6.1	0.0		
10	Frequency	2	20	29	60	21	0	2.41
	Percent	1.5	15.2	22.0	45.5	15.9		
11	Frequency	5	20	22	42	40	3	2.29
	Percent	3.8	15.2	16.7	31.8	30.3		
12	Frequency	26	45	29	21	9	2	3.45
	Percent	19.7	34.1	22.0	15.9	6.8		

* 5=to a great extent 4=more than a little bit 3=a little bit 2=hardly at all 1=not at all

TABLE II

Analysis Of Variance With Twelve Curriculum Related Items: Responses From Chairmen In Departments Of Biology, English, History, and Mathematics

	df	SS	MS	F	p
Item #1					
Between	3	8.2555	2.7518	1.921	0.1252
Within	504	721.9536	1.4324		
Total	507	730.2090			
Item #2					
Between	3	15.8770	5.2923	3.784	0.0105*
Within	517	723.0175	1.3985		
Total	520	738.8943			
Item #3					
Between	3	6.8934	2.2978	1.677	0.1710
Within	507	694.6774	1.3702		
Total	510	701.5706			
Item #4					
Between	3	6.4458	2.1486	1.371	0.2508
Within	515	807.0453	1.5671		
Total	518	813.4910			
Item #5					
Between	3	12.2494	4.0831	3.183	0.0237*
Within	488	625.9183	1.2826		
Total	491	638.1675			
Item #6					
Between	3	16.7109	5.5703	4.899	0.0023*
Within	516	586.6690	1.1370		
Total	519	603.3796			
Item #7					
Between	3	74.0660	24.6887	29.313	0.0000*
Within	514	432.9125	0.8422		
Total	517	506.9783			
Item #8					
Between	3	16.9824	5.6608	5.648	0.0008*
Within	506	507.1789	1.0023		
Total	509	524.1611			
Item #9					
Between	3	29.9949	9.9983	18.126	0.0000*
Within	515	284.0723	0.5516		
Total	518	314.0671			
Item #10					
Between	3	191.4668	63.8223	60.749	0.0000*
Within	517	543.1511	1.0506		
Total	520	734.6177			
Item #11					
Between	3	0.6042	0.2014	0.153	0.9276
Within	515	677.0104	1.3146		
Total	518	677.6145			
Item #12					
Between	3	4.0515	1.3505	1.097	0.3498
Within	515	633.9031	1.2309		
Total	518	637.9546			

* $p < .05$

TABLE III

DUNCAN'S MULTIPLE RANGE TEST FOR ITEMS REVEALING SIGNIFICANT DIFFERENCES

Item No.	Subsets			
2	Subset 1			
	Group	Math	Biology	History
	Mean	2.9767	3.2348	3.2422
	Subset 2			
	Group	Biology	History	English
	Mean	3.2348	3.2422	3.4697
5	Subset 1			
	Group	History	Biology	Math
	Mean	2.7083	2.9070	2.9220
	Subset 2			
	Group	Biology	Math	English
	Mean	2.9070	2.9920	3.1525
6	Subset 1			
	Group	History	Math	Biology
	Mean	3.0469	3.0469	3.1894
	Subset 2			
	Group	English		
	Mean	3.4848		

Table III (continued)

Item No.	Subsets			
7	Subset 1			
	Group	English		
	Mean	3.3411		
	Subset 2			
	Group	History	Math	Biology
	Mean	4.1550	4.2109	4.2652
8	Subset 1			
	Group	Biology	Math	History
	Mean	3.4251	3.5680	3.6111
	Subset 2			
	Group	English		
	Mean	3.9297		
9	Subset 1			
	Group	Biology	Math	
	Mean	3.7803	3.9213	
	Subset 2			
	Group	History		
	Mean	4.2031		
	Subset 3			
	Group	English		
	Mean	4.3939		

Table III (continued)

Item No.	Subsets	
10	Subset 1	
	Group	History
	Mean	2.1550
	Subset 2	
	Group	Biology
	Mean	2.4091

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